Groundwater Monitoring System Certification

Neal North CCR Impoundment 3B

MidAmerican Energy Company

January 24, 2025

The Power of Commitment

Contents

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1. Introduction

MidAmerican Energy Company (MidAmerican) has installed a groundwater monitoring system at coal combustion residue (CCR) Impoundment 3B at the Neal North facility in accordance with 40 CFR Part 257. GHD prepared this report to certify the groundwater monitoring system meets the requirements specified in 40 CFR §257.91 Groundwater Monitoring Systems.

2. Groundwater Monitoring System

The groundwater monitoring system at CCR Impoundment 3B consists of 16 monitoring wells (Table 1). Groundwater elevation data are collected from the 16 wells and groundwater samples are collected from 13 of the 16 monitoring wells. The 13 sampled monitoring wells and 3 other shallow monitoring wells are screened at the water table (approximately 15 to 38 feet below ground surface [bgs]) and 1 deep monitoring well is screened in a deeper portion of the alluvial aquifer (approximately 45 feet bgs). Horizontal spacing between the downgradient shallow alluvial aquifer monitoring wells ranges from approximately 500 to 900 feet. To more thoroughly assess background groundwater concentrations, an additional background monitoring well (MW-231S) was included in the groundwater monitoring network. As described in 40 CFR 257.91(a)(1)(ii), a determination of background quality may include sampling of wells that are not hydraulically upgradient of the CCR management area where sampling will provide an indication of background groundwater quality that is as representative as that provided by the upgradient wells.

Two monitoring wells (MW-104 and MW-231S) were damaged and three monitoring wells (MW-13, MW-29, and MW-209) had sustained low groundwater levels. These monitoring wells were replaced by monitoring wells MW-13R, MW-29R, MW-104R, MW-209R, and MW-231SR in 2019 and 2021. The new wells were drilled and constructed to be substantially similar to the original monitoring well except monitoring wells associated with low groundwater elevations were drilled approximately five feet deeper than the original total depth. Monitoring wells MW-13, MW-29, MW-104, MW-209, and MW-231S were plugged in accordance with Rule 567—39.8 of the Iowa Administrative Code.

The uppermost aquifer in the vicinity is the Missouri River alluvial aquifer. In general, the sediment grain size increases with depth; clays, silts, and fine sands are typically present from 0 to 30 feet bgs where the water table occurs; coarser sands and gravels are typically present below 30 feet where the deeper wells are screened. Bedrock was not encountered during drilling at CCR Impoundment 3B; however, at the adjacent Neal North CCR Monofill, an attempt was made in 1996 to drill and sample to a depth of 100 feet bgs, but coarse gravel prevented drilling beyond 62 feet bgs (MWH, 2006). Bedrock was encountered at approximately 137 feet bgs during installation of a water well at the Neal North Energy Center (MWH, 2007), located less than 1 mile west-northwest of CCR Impoundment 3B. The uppermost bedrock in the area is the Cretaceous-age Dakota Formation.

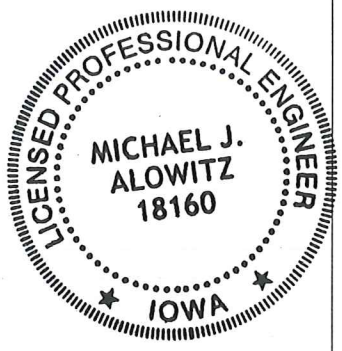
On a site-wide basis, the groundwater flow direction in the alluvial aquifer is to the west-southwest toward the Missouri River, based on the sixteen monitoring events conducted between December 2015 and December 2024. The groundwater contour maps show the groundwater elevations in the shallow portion of the alluvial aquifer have recently ranged from 1,059.82 feet at MW-104 to 1,077.13 at MW-218S, with groundwater flow directions predominantly toward the Missouri River. Tabulated groundwater elevations for gauging events are provided in Table 2.

Groundwater flow direction at CCR Impoundment 3B has been observed to be consistent with only temporal variations, primarily in response to elevated Missouri River elevations. Monitoring well MW-223S is located upgradient and monitoring wells MW-209, MW-217S, MW-218S, MW-219S, MW-220S, MW-221S(R), and MW-222S are consistently located downgradient. Monitoring wells MW-13, MW-27, and MW-29 are located south of Impoundment 3B in the upgradient direction. Monitoring well MW-231S is located northwest of Impoundment 3B in the cross--gradient direction in an area outside of CCR activities.

All monitoring wells in the groundwater monitoring system consist of 2-inch nominal inner-diameter polyvinyl chloride (PVC) casing and screen. Monitoring well construction included placement of clean silica sand in the screened interval and an annular seal of bentonite to the near surface. Monitoring well surface completions consist of either a lockable stick-up surface casing set in a concrete pad and placement of protective bollards in locations where traffic may be of concern, or a flushmount cover with a watertight well plug in high traffic areas where a stick-up well is not suitable. Review of monitoring records and well inspections indicate the monitoring wells have been operated and maintained adequately to meet the design specifications of the monitoring program.

3. Certification

I certify the CCR Impoundment 3B groundwater monitoring system has been designed and constructed to meet the requirements of 40 CFR Part 257, Section 91. The groundwater monitoring system includes the minimum number of monitoring wells specified in 40 CFR Part 257, Section 91, Paragraph (c)(1), as described in this report.



I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Iowa.

Michael J. Alowitz, P.E. — Date: 1/24/2025

License Number: 18160

My license renewal date is: December 31, 2026

Pages or sheets covered by this seal: Entire Document

4. References

MWH, 2006. Hydrogeological Investigation Report, Coal Combustion Residue Monofill, Neal North Generating Facility, Woodbury County, Iowa. December 2006.

MWH, 2007. Hydrologic Monitoring System Plan, Coal Combustion Residue Monofill, Neal North Generating Facility, Woodbury County, Iowa. August 2007.

5. Record of Revisions

Revision	Date	Revisions Made	By Whom
A	10/17/2017	Initial Issue.	GHD
B	01/30/2018	Monitoring wells MW-13, MW-27, and MW-29 added to monitoring network as background wells.	GHD
C	01/30/2020	Monitoring well MW-231S added to monitoring network as a background well.	GHD
D	01/24/2025	Monitoring wells MW-13R, MW-29R, MW-209R, and MW-231SR added to monitoring network as replacement wells for MW-13, MW-29, MW-209, and MW-231S.	GHD

Tables

Table 1

Groundwater Monitoring Well Network
MidAmerican Energy Company
Neal North CCR Impoundment 3B
Sergeant Bluff, Iowa

Monitoring Well	Use in Monitoring Network	Role in Monitoring Network
MW-13R [d]	Gauged and Sampled	Upgradient Location
MW-15R	Gauged Only	Gauging Location
MW-27	Gauged and Sampled	Upgradient Location
MW-29R [d]	Gauged and Sampled	Upgradient Location
MW-104R [c]	Gauged Only	Gauging Location
MW-207	Gauged Only	Gauging Location
MW-209R [d]	Gauged and Sampled	Downgradient Well
MW-210 [a]	Gauged Only	Gauging Location
MW-217S	Gauged and Sampled	Downgradient Well
MW-218S	Gauged and Sampled	Downgradient Well
MW-219S	Gauged and Sampled	Downgradient Well
MW-220S	Gauged and Sampled	Downgradient Well
MW-221SR [b]	Gauged and Sampled	Downgradient Well
MW-222S	Gauged and Sampled	Downgradient Well
MW-223S	Gauged and Sampled	Upgradient Well
MW-231SR [e]	Gauged and Sampled	Upgradient Well

Notes:
[a] Well is screened in deep portion of the alluvial aquifer.
[b] MW-221S was abandoned in September 2016 due to damage and replaced by MW-221SR.
[c] MW-104 was abandoned in August 2019 due to damage and replaced by MW-104R.
[d] MW-13, MW-29, and MW-209 were abandoned and replaced by MW-13R, MW-29R, and MW-209R in June 2021 due to low water level conditions.
[e] MW-231S was abandoned in December 2021 due to damage and replaced by MW-231SR.

Table 2

Groundwater Elevation Data
MidAmerican Energy Company
Neal North CCR Impoundment 3B
Sergeant Bluff, Iowa

Well	Top of Casing (NAVD)	Total Depth (feet BTOC)	8-Dec-2015	1-Mar-2016	7-Jun-2016	20-Sep-2016	19-Dec-2016	21-Feb-2017	24-Apr-2017	6-Jul-2017	12-Sep-2017	19-Dec-2017	29-Jan-2018	16-Apr-2018	27-Aug-2018	5-Mar-2019
MW-13	1,088.12	30.6	1,064.13	1,063.60	1,065.38	1,063.76	1,062.50	1,062.04	1,062.97	1,064.10	1,064.04	1,063.27	1,062.05	1,063.12	1,067.25	1,062.21
MW-13R	1,089.22	38.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-15R	1,089.45	37.2	1,063.26	1,062.83	1,064.63	1,063.27	1,061.71	1,061.33	1,062.53	1,063.61	1,063.42	1,062.54	1,061.33	1,062.78	1,066.90	1,061.34
MW-27	1,087.29	33.4	1,063.35	1,062.82	1,064.61	1,063.20	1,061.77	1,061.25	1,062.32	1,063.54	1,063.39	1,062.56	1,061.32	1,062.58	1,066.84	1,061.39
MW-29	1,090.01	29.7	1,064.28	1,063.71	1,065.49	1,064.08	1,062.61	1,062.15	1,063.08	1,064.20	1,064.12	1,063.36	1,062.33	1,063.21	1,067.28	1,062.28
MW-29R	1,088.92	35.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-104	1,076.93	21.4	1,061.52	1,061.22	1,062.08	1,061.78	1,060.16	1,059.82	1,061.30	1,062.49	1,062.19	1,061.17	1,059.84	1,061.83	1,066.22	1,059.81
MW-104R	1,076.98	21.4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-207	1,079.33	26.1	1,062.92	1,062.40	1,064.21	1,062.88	1,061.47	1,060.91	1,062.00	1,063.27	1,063.14	1,062.38	1,061.10	1,062.34	1,066.62	1,061.23
MW-209	1,077.04	18.4	1,064.51	1,064.00	1,065.69	1,064.26	1,062.94	1,062.33	1,063.18	1,064.31	1,064.27	1,063.65	1,062.47	1,063.29	1,067.31	1,062.72
MW-209R	1,076.68	27.3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-210 [a]	1,077.12	48.8	1,064.63	1,064.10	1,065.79	1,064.36	1,063.01	1,062.41	1,063.31	1,064.40	1,064.36	1,063.74	1,062.55	1,063.40	1,066.42	1,062.77
MW-217S	1,092.11	38.2	1,063.18	1,062.77	1,064.55	1,063.63	1,061.87	1,061.94	1,062.75	1,064.27	1,063.80	1,062.60	1,061.38	1,062.98	1,066.63	1,060.97
MW-218S	1,089.35	30.1	1,076.30	1,076.94	1,076.50	1,077.08	1,077.00	1,076.83	1,077.13	1,076.65	1,077.06	1,076.31	1,076.28	1,076.41	1,074.73	1,073.20
MW-219S	1,087.33	30.2	1,076.12	1,074.48	1,073.44	1,075.57	1,075.74	1,075.73	1,075.83	1,074.78	1,075.72	1,075.32	1,075.61	1,075.23	1,075.39	1,073.84
MW-220S	1,085.88	33.4	1,063.93	1,063.43	1,065.21	1,063.83	1,062.34	1,061.89	1,062.95	1,064.44	1,064.69	1,066.05	1,064.21	1,065.55	1,068.84	1,064.05
MW-221S	1,085.75	29.4	1,064.34	1,063.76	1,065.48	Plugged	Plugged	Plugged	Plugged	Plugged	Plugged	Plugged	Plugged	Plugged	Plugged	Plugged
MW-221SR	1,085.10	30.4	NA	NA	NA	1,063.99	1,062.61	1,062.06	1,062.95	1,064.06	1,064.02	1,063.34	1,062.14	1,063.08	1,067.13	1,062.28
MW-222S	1,086.57	30.1	1,063.89	1,063.35	1,065.09	1,063.73	1,062.37	1,061.74	1,062.67	1,063.89	1,063.85	1,063.18	1,061.96	1,062.85	1,066.97	1,062.17
MW-223S	1,081.33	26.7	1,064.94	1,064.40	1,066.04	1,064.56	1,063.31	1,062.65	1,063.37	1,064.48	1,064.49	1,064.01	1,062.81	1,063.41	1,067.34	1,063.19
MW-231S	1,079.55	26.6	NA	NA	NA	NA	NA	NA	NA	NA	NA	1,060.25	NA	1,060.92	1,065.58	1,058.82
MW-231SR	1,080.09	29.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
[a] Well is screened in deep portion of the alluvial aquifer.
BTOC - Below top of casing.
CCR - Coal combustion residual.
NA - Not applicable/not available.
NAVD - North American Vertical Datum 1988.
MW-223S was modified on June 1, 2022 to accommodate recent construction; the TOC was extended from 1077.99 to 1081.33 and ground surface was raised from 1076.3 to 1081.7.
MW-27 was modified on Oct. 26, 2022 to accommodate well pad settlement; the TOC was cut from 1087.56 to 1087.29.

Table 2

Groundwater Elevation Data
MidAmerican Energy Company
Neal North CCR Impoundment 3B
Sergeant Bluff, Iowa

Well	Top of Casing (NAVD)	Total Depth (feet BTOC)	13-May-2019	16-Sep-2019	9-Mar-2020	26-May-2020	21-Sep-2020	1-Feb-2021	11-Oct-2021	7-Mar-2022	6-Jun-2022	12-Sep-2022	27-Mar-2023	11-Sep-2023	22-Jan-2024	19-Feb-2024
MW-13	1,088.12	30.6	1,068.06	1,069.47	1,065.10	1,065.18	1,062.61	1,058.85	Plugged	Plugged	Plugged	Plugged	Plugged	Plugged	Plugged	Plugged
MW-13R	1,089.22	38.2	NA	NA	NA	NA	NA	NA	1,059.91	1,057.21	1,058.69	1,059.43	1,057.12	1,059.43	1,057.87	1,057.78
MW-15R	1,089.45	37.2	1,067.98	1,069.69	1,064.65	1,065.20	NA	1,058.15	1,059.65	1,056.54	1,058.32	1,059.19	1,056.65	1,059.23	1,056.91	1,056.63
MW-27	1,087.29	33.4	1,067.68	1,069.18	1,064.43	1,064.53	1,061.96	1,058.13	1,059.61	1,056.67	1,058.41	1,059.20	1,056.71	1,059.30	NA	NA
MW-29	1,090.01	29.7	1,068.10	1,069.46	1,065.22	1,065.31	1,062.74	1,059.83	Plugged	Plugged	Plugged	Plugged	Plugged	Plugged	Plugged	Plugged
MW-29R	1,088.92	35.2	NA	NA	NA	NA	NA	NA	1,059.83	1,057.16	1,058.64	1,059.37	1,057.06	1,059.32	NA	NA
MW-104	1,076.93	21.4	1,067.72	Plugged	Plugged	Plugged	Plugged	Plugged	Plugged	Plugged	Plugged	Plugged	Plugged	Plugged	Plugged	Plugged
MW-104R	1,076.98	21.4	NA	1,069.79	1,063.47	1,063.55	1,060.74	1,056.66	1,058.59	DRY	1,056.88	1,058.03	DRY	1,058.94	1,055.77	1,055.48
MW-207	1,079.33	26.1	1,067.77	1,069.48	1,064.40	1,064.53	1,061.81	1,058.07	1,059.32	NA	NA	1,058.62	DRY	1,058.53	NA	NA
MW-209	1,077.04	18.4	1,068.16	1,069.64	1,065.47	1,065.56	1,062.95	1,059.36	Plugged	Plugged	Plugged	Plugged	Plugged	Plugged	Plugged	Plugged
MW-209R	1,076.68	27.3	NA	NA	NA	NA	NA	NA	1,059.98	1,057.42	1,058.53	1,059.38	1,057.08	1,059.18	NA	NA
MW-210 [a]	1,077.12	48.8	1,068.25	1,069.73	1,065.65	1,065.64	1,063.04	1,059.44	1,060.31	1,057.73	1,058.92	1,059.69	1,057.37	1,059.51	NA	NA
MW-217S	1,092.11	38.2	1,067.84	1,069.69	1,064.26	1,064.36	1,061.70	1,057.90	1,059.28	1,056.03	1,057.66	1,058.66	1,055.93	1,058.61	1,056.68	1,056.33
MW-218S	1,089.35	30.1	1,074.46	1,073.50	1,073.34	1,074.25	1,073.23	1,073.61	1,072.11	1,070.92	1,070.92	1,070.48	1,069.60	1,069.48	1,069.24	1,069.34
MW-219S	1,087.33	30.2	1,074.62	1,073.32	1,073.97	1,074.36	1,071.28	1,071.55	1,072.12	1,071.21	1,070.23	1,072.04	1,071.13	1,070.51	1,070.43	1,070.79
MW-220S	1,085.88	33.4	1,070.35	1,071.18	1,068.18	1,068.76	1,067.07	1,063.56	1,060.21	1,057.29	1,058.75	1,059.44	1,057.07	1,059.39	NA	NA
MW-221S	1,085.75	29.4	Plugged	Plugged	Plugged	Plugged	Plugged	Plugged	Plugged	Plugged	Plugged	Plugged	Plugged	Plugged	Plugged	Plugged
MW-221SR	1,085.10	30.4	1,068.05	1,069.49	1,065.15	1,065.25	1,062.66	1,059.02	1,059.96	1,057.32	1,058.67	1,059.41	1,057.04	1,059.24	NA	NA
MW-222S	1,086.57	30.1	1,067.95	1,069.45	1,065.02	1,065.14	1,062.55	1,058.96	1,059.80	1,057.05	1,058.29	1,059.14	1,056.66	1,058.97	NA	NA
MW-223S	1,081.33	26.7	1,068.10	1,069.53	1,065.78	1,065.84	1,063.29	1,059.83	1,060.38	NA	1,058.75	1,059.43	1,057.27	1,059.15	NA	1,058.02
MW-231S	1,079.55	26.6	1,067.23	1,069.20	1,062.73	1,062.90	1,060.01	1,055.85	1,058.06	Plugged	Plugged	Plugged	Plugged	Plugged	Plugged	Plugged
MW-231SR	1,080.09	29.1	NA	NA	NA	NA	NA	NA	NA	1,047.04	1,056.25	1,057.44	1,054.21	1,057.50	1,054.95	1,054.45

Notes:
[a] Well is screened in deep portion of the alluvial aquifer.
BTOC - Below top of casing.
CCR - Coal combustion residual.
NA - Not applicable/not available.
NAVD - North American Vertical Datum 1988.
MW-223S was modified on June 1, 2022 to accommodate recent construction; the TOC was extended from 1077.99 to 1081.33 and ground surface was raised from 1076.3 to 1081.7.
MW-27 was modified on Oct. 26, 2022 to accommodate well pad settlement; the TOC was cut from 1087.56 to 1087.29.

Table 2

Groundwater Elevation Data
MidAmerican Energy Company
Neal North CCR Impoundment 3B
Sergeant Bluff, Iowa

Well	Top of Casing (NAVD)	Total Depth (feet BTOC)	18-Mar-2024	4-Jun-2024	20-Aug-2024	9-Sep-2024	11-Nov-2024	9-Dec-2024
MW-13	1,088.12	30.6	Plugged	Plugged	Plugged	Plugged	Plugged	Plugged
MW-13R	1,089.22	38.2	1,057.48	1,060.67	1,062.07	1,061.84	1,061.57	1,060.72
MW-15R	1,089.45	37.2	1,056.44	1,060.46	1,061.30	1,061.50	1,061.16	1,059.97
MW-27	1,087.29	33.4	1,057.02	1,060.40	1,061.51	1,061.45	1,061.34	1,060.27
MW-29	1,090.01	29.7	Plugged	Plugged	Plugged	Plugged	Plugged	Plugged
MW-29R	1,088.92	35.2	1,057.43	1,060.59	1,061.67	1,061.75	1,061.48	1,060.65
MW-104	1,076.93	21.4	Plugged	Plugged	Plugged	Plugged	Plugged	Plugged
MW-104R	1,076.98	21.4	DRY	1,059.16	1,059.66	1,059.96	1,059.67	1,058.05
MW-207	1,079.33	26.1	1,056.30	1,059.72	1,060.59	1,060.76	NA	NA
MW-209	1,077.04	18.4	Plugged	Plugged	Plugged	Plugged	Plugged	Plugged
MW-209R	1,076.68	27.3	1,057.53	1,060.52	1,061.08	1,061.63	NA	NA
MW-210 [a]	1,077.12	48.8	1,057.82	1,060.84	1,061.90	1,061.94	NA	NA
MW-217S	1,092.11	38.2	1,056.28	1,059.79	1,060.61	1,060.78	1,060.51	1,059.41
MW-218S	1,089.35	30.1	1,069.31	1,071.10	1,071.16	1,071.15	1,070.16	1,069.93
MW-219S	1,087.33	30.2	1,071.05	1,073.92	1,073.51	1,072.85	1,071.82	1,071.47
MW-220S	1,085.88	33.4	1,057.58	1,061.97	1,063.94	1,064.17	NA	NA
MW-221S	1,085.75	29.4	Plugged	Plugged	Plugged	Plugged	Plugged	Plugged
MW-221SR	1,085.10	30.4	1,057.48	1,060.59	1,061.63	1,061.68	NA	NA
MW-222S	1,086.57	30.1	1,057.12	1,060.25	1,061.27	1,061.36	NA	NA
MW-223S	1,081.33	26.7	1,057.77	1,060.56	1,061.70	1,061.68	1,061.49	1,061.05
MW-231S	1,079.55	26.6	Plugged	Plugged	Plugged	Plugged	Plugged	Plugged
MW-231SR	1,080.09	29.1	1,054.41	1,058.53	1,059.06	1,059.35	1,059.12	1,057.53

Notes:
[a] Well is screened in deep portion of the alluvial aquifer.
BTOC - Below top of casing.
CCR - Coal combustion residual.
NA - Not applicable/not available.
NAVD - North American Vertical Datum 1988.
MW-223S was modified on June 1, 2022 to accommodate recent construction; the TOC was extended from 1077.99 to 1081.33 and ground surface was raised from 1076.3 to 1081.7.
MW-27 was modified on Oct. 26, 2022 to accommodate well pad settlement; the TOC was cut from 1087.56 to 1087.29.

Figure

LEGEND

MW-29	SHALLOW GROUNDWATER MONITORING WELL
MW-30	DEEP GROUNDWATER MONITORING WELL
△	BACKGROUND SAMPLING LOCATION
□	DOWNGRADIENT SAMPLING LOCATION
◇	GAUGING LOCATION

0 250 500 ft

1" = 500 ft

Coordinate System:
STATE PLANE
IOWA NORTH NAD83

N

GHD

MIDAMERICAN ENERGY COMPANY
NEAL NORTH CCR IMPOUNDMENT 3B
SERGEANT BLUFF, IOWA

SITE MAP AND MONITORING NETWORK

Project No. **12576482**
Date **January 2025**

FIGURE 1

Filename: N:\US\Des Moines\Projects\563\12576482\Digital_Design\ACAD\Figures\RPT015\12576482-GHD-00-00-RPT-EN-D101_DE-015.dwg
Plot Date: 06 January 2025 5:31 PM